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Simultaneous determination of Hugoniot and Isentrope in gas gun experiments

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Simultaneous determination of Hugoniot and Isentrope in gas gun experiments

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We have been exploring the use of the ‘reverse ballistics’ method to obtain Hugoniot and off Hugoniot Equation Of State. This method uses the unknown sample as the flyer and collides it into a window whose EOS is well known. A VISAR determines the particle velocity which when combined with the windows EOS gives a direct determination of the pressure. Since the pressure and particle velocity are continuous across the interface the shock speed in the flyer can be determined: $U_s = P/(\rho U_p)$. Subtracting the time of arrival of the shock at the back of the flyer from the times of arrival of the rarefaction wave allows the determination of the release isentrope centered at the measured Hugoniot point and extending down to the release pressure as determined by the impedance of the sabot. Besides obtaining both Hugoniot and isentrope data on a single shot, this method has an advantage in that all the timing information is accomplished within the interferometer, i.e. no dependence of cable delays etc.

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